

PhD Position

- **Thesis proposal:** Liquid crystal sensors to monitor pesticides in air
- **Date:** September 2023 - August 2025
- **Funding:** ANR
- **Scientific theme (disciplinary field):** Sensors (Chemistry, Physicochemistry, Interfaces)
- **Host laboratories:**
 - Laboratoire de Physicochimie des Polymères et Interfaces (CY Cergy Paris Université, Cergy - FRANCE)
 - Département Optique (IMT Atlantique, Brest - FRANCE)
- **Training expected:** Master 2 or Engineer in Chemistry and/or Physicochemistry.
- **Required skills:** General knowledge in chemistry and physicochemistry, surface modification, knowledge in micro-electronic and python programming will be an advantage.

- **Context**

Air pollution by pesticides is a component of atmospheric pollution that remains less documented than other environments (water, soil, food) and represents a topical health problem¹. Furthermore, there is a lack of tools to monitor respiratory exposure to pesticides during spray application or post application. The objective of the ANR project OPAL, which the thesis is part, is to answer it by providing wearable devices for on-site and real time monitoring of pesticides in air. To do this, transducers based on the principle of anchoring transition of liquid crystals (LCs) will be used². The project consortium is composed of three academic research laboratories that bring together the complementary expertise needed.

- **Subject**

The purpose of this thesis will be to develop and test sensors of pesticides in air based on liquid crystal transducers. One part of the thesis work will deal with identification of interfaces having a high selectivity in the anchoring transition of a LC in presence of a target pesticide from molecular modelling and experimental tests (preparation and characterization of modified substrates, LCs anchoring to their surface, anchoring transition with pesticide exposure). A second part will concern preparation of transducers combining at least the LC, a modified substrate and a protective porous membrane with reliable and robust technological processes. Then, several LC transducers will be combined to form an array and associated with LEDs, photodiodes and an electronic card to provide a full sensor. Furthermore, algorithms to process the signal and extract information on the presence and / or content of pesticide will be developed. In a last part of the project, liquid crystal based sensors will be made and dedicated to realize sensing tests to evaluate their performances (detection, linear range, selectivity...) in partnership with the third member of the consortium who will develop in parallel of the thesis the exposure chamber.

In this multidisciplinary project, the Ph.D. student will perform part of the work at the LPPI (CYU) and the other part at the Optic Department (IMT Atlantique) as part of a co-supervision thesis. He/She will develop skills in functionalization and characterization of surfaces, technological processes, electronics, development of sensors and their integration.

1. ANSES. *Campagne nationale exploratoire des pesticides dans l'air ambiant. Premières interprétations sanitaires.* (2020).
2. Shah, R. R. Principles for Measurement of Chemical Exposure Based on Recognition-Driven Anchoring Transitions in Liquid Crystals. *Science (80-.).* **293**, 1296–1299 (2001).

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- **Candidate background**

Chemist or physicochemist with experience in gas sensors, liquid crystals, thin layers, surface modifications.

Main skills

General knowledge in chemistry, physicochemistry, electrochemistry, modification and characterization of interfaces, especially (contact angle, spectroscopy UV-Vis, FTIR, Raman), microscopic characterization (SEM-EDX, AFM), microelectronic process (photolithography and assembly).

Additional skills

Spirit of synthesis, of rigor and openness, good oral and written communication.

- **Documents to apply**

- CV
- Cover Letter
- Master's transcripts

- **Contact to apply**

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